BA

(19) (11) Publication number: **03130522**

Generated Document.

PATENT ABSTRACTS OF JAPAN

(21) Application number: **01263994**

(22) Application date: **12.10.89**

(51) Intl. Cl.: **F01N 3/08** B01D 53/36

(30) Priority:

(43) Date of application publication: **04.06.91**

(84) Designated contracting states:

(71) Applicant: **MITSUBISHI HEAVY IND LTD**

(72) Inventor: **KAWAMURA SATOSHI**

(74) Representative:

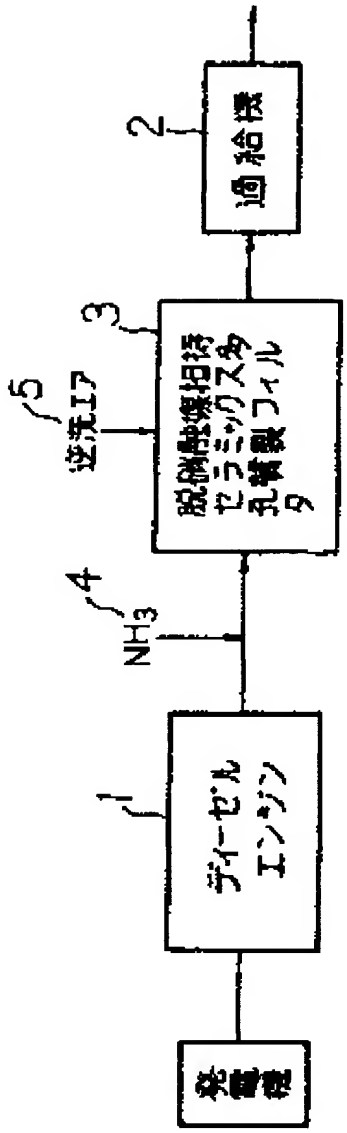
(54) DIESEL ENGINE EXHAUST GAS PROCESSOR

(57) Abstract:

PURPOSE: To synthetically process exhaust gas with structure formed in compactness by arranging an ammonia injector and a porous ceramics-made filter carrying a denitration catalyst successively from the upstream side between the outlet of a Diesel engine and the inlet of a supercharger.

CONSTITUTION: Exhaust gas in the outlet of a Diesel engine 1 is dynamic pressure-collected by a supercharger 2. Here before the supercharger 2, a denitration catalyst-carrying ceramics porous filter 3 is arranged. While before the filter 3, an ammonia injector 4 is arranged. That is, the filter 3 and the injector 4 are arranged between the outlet of the engine 1 and the inlet of the supercharger 2. Thus by ensuring a temperature necessary for denitration reaction, exhaust gas is synthetically processed by respectively ensuring a filter function and a denitration function or the like

while attaining the compactness or the like of a device total unit.



PATENT ABSTRACTS OF JAPAN

(11) Publication number : 03-130522
(43) Date of publication of application : 04.06.1991

(51) Int.Cl. F01N 3/08
B01D 53/36

(21) Application number : 01-263994
(22) Date of filing : 12.10.1989

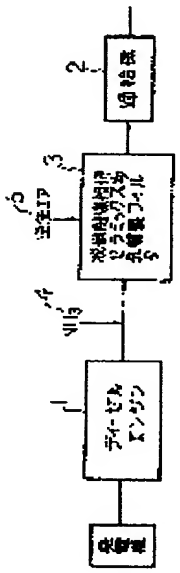
(71) Applicant : MITSUBISHI HEAVY IND LTD
(72) Inventor : KAWAMURA SATOSHI

(54) DIESEL ENGINE EXHAUST GAS PROCESSOR

(57) Abstract:

PURPOSE: To synthetically process exhaust gas with structure formed in compactness by arranging an ammonia injector and a porous ceramics-made filter carrying a denitration catalyst successively from the upstream side between the outlet of a Diesel engine and the inlet of a supercharger.

CONSTITUTION: Exhaust gas in the outlet of a Diesel engine 1 is dynamic pressure-collected by a supercharger 2. Here before the supercharger 2, a denitration catalyst-carrying ceramics porous filter 3 is arranged. While before the filter 3, an ammonia injector 4 is arranged. That is, the filter 3 and the injector 4 are arranged between the outlet of the engine 1 and the inlet of the supercharger 2. Thus by ensuring a temperature necessary for denitration reaction, exhaust gas is synthetically processed by respectively ensuring a filter function and a denitration function or the like while attaining the compactness or the like of a device total unit.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against xaminer's decision of rejection]

[Date of requesting appeal against examiner's

decision of rejection]
[Date of extinction of right]

BA

Japanese Patent Agency (JP)
Patent Publication Bulletin (A)

Patent Disclosure Number	:	**3-130522**
Patent Disclosure Date	:	June 4, 1991
Int. Cl.[5]	:	F 01 N 3/08
		B 01 D 53/36
Identification Code	:	B
		101 A
Intra-agency Classification No.:		7910-3C
		8616-4D

Patent Examination not Requested

Number of Inventions : 1 (total 4 pages)

Title of Invention **Diesel Engine Exhaust Gas Processor**

Application Number : 1-263994
Application Date : October 12, 1989

Inventor : Toshi Kawamura
Kobe Shipyard, Mitsubishi Jukogyo Kabushiki Gaisha
1-1-1 Wadasaki-cho
Hyogo-Ku, Kobe-Shi
Hyogo-Ken

Applicant : Mitsubishi Jukogyo Kabushiki Gaisha
2-5-1 Marunouchi
Chiyooda-Ku, Tokyo-To

Proxy : Akira Uchida, Patent Attorney,
and 2 others

Specification

1. Title of Invention

A diesel engine exhaust gas processor.

2. Scope for Patent Claims

A diesel engine exhaust gas processor in which an ammonia gas injector and a porous ceramic filter with its pores loaded with an NO_x-removing catalyst are arranged in sequence, starting upstream of the diesel engine exhaust gas between the downstream side of the diesel engine exhaust gas flow and the intake for the supercharger of the same engine.

3. Detailed Description of the Invention

[Area of Industrial Application]

The present invention concerns a diesel engine exhaust gas processor that is suitable for the purification of diesel engine exhaust gas.

[Conventional Technology]

The components of diesel engine exhaust gas undergo complex and marked changes from the effects of the engine operating conditions, such as smoke generation when the engine is started, a high NO_x environment during driving, and tar decomposition associated with incomplete combustion of the engine's fuel oil. Facing this situation, designs have been proposed to deal with each problem; but complete measures to solve all necessary objectives, such as dust removal from smoke, prevention of clogging by hydrocarbons, and denitration have not been implemented.

[Problems to Be Solved by the Present Invention]

The exhaust gas from a diesel engine contains a large quantity of NO_x (1,000 to 2,000 ppm) and there has been a move by a government agency to reinforce the existing regulations to cut down this NO_x content. The use of a honeycomb-type denitration catalyst, which has been used to cleanse conventional boiler exhaust gases, was tried but it was found to be less than satisfactory for a diesel exhaust gas processor because it was bulky, the device deteriorated due to the deposition of black soot and tar components contained in the exhaust gas, and the denitration device alone was unable to remove the black soot. Ceramic filters have been used

experimentally to remove black soot; but the device deteriorated when it became clogged with the black soot or a separate apparatus for denitration had to be added because the filter did not remove the NO_x. Thus it was also unsuitable as a complete exhaust processor.

In view of the current technological level described above, the present invention is intended to offer a device that will process diesel engine exhaust gas completely.

[Method to Solve the Problems Cited Above]

A diesel engine exhaust gas processor in which an ammonia gas injector and a porous ceramic filter with its pores loaded with an NO_x-removing catalyst are arranged in sequence, starting at upstream from the diesel engine exhaust gas between the downstream side of the diesel engine exhaust gas flow and the intake for the supercharger of the same engine.

If the diesel engine is a stationary type, the gas exhausted from it is normally characterized as 1.5 to 2.0 kg/cm^2 G and at 350 to 400°C in front of a supercharger. It contains unburned carbon, tar components, and NO_x, all of which must be removed. Because conventional filtering textiles are not thermally resistant, they are unsuitable. A porous filter that can withstand high temperatures is used for this invention. Although other materials may be suitable, a porous ceramic filter with a porosity around 150 μm, in which the pores carry a denitrifying catalyst, is commonly used. Neither is it a prerequisite but an ordinary denitrifying catalyst, a carrier, TiO_2, which carries oxides of V, Mo, or W, is commonly used. A backwash device, such as those employed in a bag filter may be attached to this porous ceramic filter so that any dust adhering to the filter can be removed by back washing.

The porous ceramic filter described above is installed between the downstream side of the diesel engine exhaust port and the intake of the supercharger. The pressure differential between the filter input and output is normally set to be between 200 and 300 Aq.

To prevent clogging from the dust that collects in the porous ceramic filter for the diesel engine exhaust gas processor of the present invention, it is desirable that in an optimal example of application, the pore diameter of the surface layer on the dust accumulation side (the filtering surface on the exhaust gas intake side) be smaller than that of the pores on the downstream side at the filter cross section. In another optimal example, the front surface of the filter carries an oxidizing catalyst (e.g., Pt) for the combustion of black soot and hydrocarbons.

In the diesel engine exhaust gas processor device of the present invention, an ammonia injector is installed at the upstream side of the porous ceramic filter described above. This injector is necessary for the denitration reaction. It is desirable that the injector be designed so that ammonia will be injected in a spray form.

[Action]

By using a porous ceramic material, the filter can function at high temperatures. By injecting ammonia in a spray form into the upstream side of the filter, NO_x contained in the exhaust gas are reduced (as indicated below) through the action of the denitration catalyst that is contained within the filter:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$

Because of the high temperature range of the exhaust gas (350 to 400°C), this reaction takes place satisfactorily.

The carbon that has not burned and the engine oil mist that is contained in the exhaust gas are captured at the front surface of the filter and can be shaken off through periodic back washing.

In a filter that carries an oxidizing catalyst on its front surface, such as platinum or palladium, the tar and oil components that adhere to the said filter can be burned with subsequent combustion of the carbon that has not burned.

By installing the filter described above at the high pressure section in front of the supercharger, the high temperature that is needed for the denitration reaction may be achieved. The real gas flow layer may also be condensed by pressure.

[Examples]

Figure 1 is an abbreviated drawing of an example of the present invention in which diesel engine exhaust gas is processed.

This example is applied to process exhaust gas from a stationary-type diesel engine used as a generator. The exhaust gas at the outlet of diesel engine 1 is characterized as follows: 350 to 400°C and 1.5 to 2.0 kg/cm^2G. This gas is normally recovered under dynamic pressure by using supercharger 2 so that the combustion efficiency of diesel engine 1 is raised. To minimize the filtration surface, denitration catalyst-carrying porous ceramic filter 3 of the present invention is installed in front of supercharger 2, as shown in Figure 1; and ammonia injector 4 is placed in front of this filter. The figure also shows backwash air supplier 5.

The porous ceramic filter is the key component of the diesel engine exhaust gas processor of the present invention. Its shape and design may be completely identical to conventional bag filters or may be of diverse forms (e.g., the so-called heat-exchanger type, in which the input and outlet are arranged alternately, sandwiching the filter surface). In all of these designs, a denitration catalyst is carried in the pores of the porous ceramic filter.

Figure 2 shows another design. The gas input side of the filter shown in Figure 2 is composed of layer 6, having fine ceramic particles of smaller diameter, while the back side is composed of pore layer 7 composed of coarse ceramic particles with a relatively large diameter. The denitration catalyst is carried inside the latter (porous layer 7). In addition, a hydrocarbon combustive catalyst (such as Pt or Pd) is carried on the surface of the fine ceramic particle layer that composes the former (fine pore layer 6).

The diesel engine exhaust gas that contains substances, such as carbon that has not burned, refluxes through the porous ceramic filter. The tar and carbon that has not burned are filtered on the surface. The NH_3 and NO_x that are injected upstream are reduced over the denitration catalyst (such as TiO_2/V_2O_5) that is carried on the coarse particles downstream and discharged as harmless nitrogen and water from the exhaust port.

When a catalyst (such as Pt or Pd) is carried by fine pore layer 6 of the porous ceramic layer, the tar components contained in the dust on the filter surface undergo combustion with the aid of a catalyst.

In either circumstance, dust and other contaminants that have accumulated on the filter surface are shaken off and removed by backwashing via air 5 from downstream as in an ordinary bag filter.

[Effects of the Present Invention]

By installing a porous ceramic filter and an ammonia injector between the exhaust port of the diesel engine and the intake to the supercharger, as in the present invention, the temperature that is needed for the denitration reaction can be maintained. Even at a high temperature, the apparent flow volume in processing is not reduced much because of the pressure. With the filtration speed higher at this pressure in comparison with that at ambient, the apparatus can be made more compact. The high operating pressure allows a certain latitude in the pressure loss across the filter in comparison with that conducted at the side of atmospheric side.

Because the denitration catalyst is borne by the porous ceramic filter, not only the filter function but also a denitration function are added to the filter. Thus the device becomes a complete simultaneous processor for diesel engine exhaust gases.

A platinum or palladium catalyst may clog a filter. This problem can be alleviated and the life of the filter prolonged by subjecting the tar and oil components in the exhaust gas to combustion on the filter surface.

4. Brief Description of Drawings

Figure 1 is an abbreviated drawing showing an example of application of the device of the present invention. Figure 2 is a simulation of the porous ceramic filter, which is the key part of the present invention.

Patent Attorneys:

Akira Uchida

Ryoichi Ogihara

Atsuo Anzai

Fig. 1

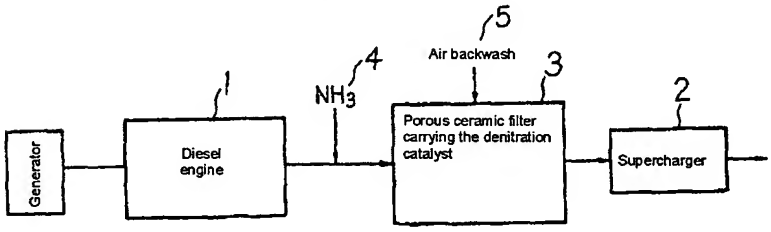


Fig. 2